UNITED STATES PATENT AND TRADEMARK OFFICE
DOCUMENT CLASSIFICATION BARCODE SHEET

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CATEGORY:

CLEARED

ADDRESS
CONTACT IF FOUND:

527 Rec'd PCT/PTO 20 NOV 2000

FORM PTO-1390 (Modified) (REV 5-93) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER 016794/0415

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U S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) Unassigned 09/700735

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE99/00790	March 20, 1999	March 20, 1999

TITLE OF INVENTION
COMPOSITE MATERIAL HAVING A REINFORCED CONNECTING REGION

APPLICANT(S) FOR DO/EO/US
Boris KOLESNIKOV, Holger WILMES, Axel HERRMANN and Arno PABSCH

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   - ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   - ☒ has been transmitted by the International Bureau.
   - ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   - ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   - ☐ have been transmitted by the International Bureau.
   - ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   - ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information:

529 Rec'd PCT/PTO 20 NOV 2000

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.50) Unassigned 09/700735	INTERNATIONAL APPLICATION NO. PCT/DE99/00790	ATTORNEY'S DOCKET NUMBER 016794/0415

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO $860.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) $690.00		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2) $710.00		
Neither international preliminary examination fee (37 CFR 1.482) nor International search fee (37 CFR 1.445(a)(2)) paid to USPTO $1,000.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) $100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than 20 Months from the earliest claimed priority date (37 CFR 1.492(e))	0.00	

Claims	Number Filed		Included in Basic Fee		Extra Claims		Rate	CALCULATIONS	PTO USE ONLY
Total Claims	14	-	20	=	0	×	$18.0	0.00	
Independent Claims	1	-	3	=	0	×	$80.0	0.00	
Multiple dependent claim(s) (if applicable)							$270.0	0.00	

	CALCULATIONS	PTO USE ONLY
TOTAL OF ABOVE CALCULATIONS =	$860.00	
Reduction by ½ for filing by small entity, if applicable. (Note 37 CFR 1.27).	430.00	
SUBTOTAL =	$430.00	
Processing fee of $130.00 for furnishing English translation later the 20 months from the earliest claimed priority date (37 CFR 1.492(f). +	0.00	
TOTAL NATIONAL FEE =	$430.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property +	40.00	
TOTAL FEES ENCLOSED =	$470.00	
Amount to be: refunded	$	
charged	$	

a. ☒ A check in the amount of $470.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. 19-0741 in the amount of $470.00 to the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-0741. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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34371

SIGNATURE

Glenn Law

NAME / RICHARD L. SCHWAAB

REGISTRATION NUMBER 25,479

09/700735
529 Rec'd PCT/PTC 20 NOV 2000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No. 016794/0415

In re patent application of

Boris KOLESNIKOV et al.

Serial No. Unassigned

Filed: Concurrently Herewith

For: COMPOSITE MATERIAL HAVING A REINFORCED CONNECTING REGION

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination of the above-identified application, Applicants respectfully request that the following amendments be entered into the application:

IN THE CLAIMS:

Claim 4, lines 1 and 2, please delete "one of Claims 1 to 3" and insert --Claim 1--.

Claim 5, lines 1 and 2, please delete "one of Claims 1 to 4" and insert --Claim 1--.

Claim 6, lines 1 and 2, please delete "one of Claims 1 to 5" and insert --Claim 1--.

Claim 8, lines 1 and 2, please delete "one of Claims 1 to 7" and insert --Claim 1--.

Claim 10, lines 1 and 2, please delete "one of Claims 1 to 9" and insert --Claim 1--.

Claim 11, lines 1 and 2, please delete "one of Claims 1 to 10" and insert --Claim 1--.

Claim 12, lines 1 and 2, please delete "one of Claims 1 to 11" and insert --Claim 1--.

Claim 13, lines 1 and 2, please delete "one of Claims 1 to 12" and insert --Claim 1--.

Claim 14, lines 1 and 2, please delete "one of Claims 1 to 13" and insert --Claim 1--.

REMARKS

Applicants respectfully request that the foregoing amendments to Claims 4-6, 8, and 10-14 be entered in order to avoid this application incurring a surcharge for the presence of one or more multiple dependent claims.

Respectfully submitted,

34371

November 20, 2000
Date

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Composite material having a reinforced connecting region

The invention relates to a composite material comprising a fiber composite, a large number of fiber layers embedded in a polymer matrix, some of which preferably have fiber directions which differ from fiber directions of other fiber layers, and a connecting region formed using a reinforcement material with a high embedding strength, with a transitional region being formed between the fiber composite and the connecting region, in which fiber layers abut against the reinforcement material of the connecting region.

Modern fiber composites with a polymer matrix, for example carbon fiber or glass fiber reinforced plastics (CFC or GFC) have high tensile and compressive strength. Fiber layers with fiber directions lying in the tension and compression direction are responsible for the high tensile and compressive strength. It is normal to design a fiber composite with fiber directions lying at 0°, 90° and +/- 45° or the like with respect to the longitudinal direction. For high tensile strength, the proportion of the 0° layers is greater than the respective proportions of the other fiber layers with different fiber directions.

As a rule, it is necessary to connect fiber composite components produced in such a way to other components of the same type or a different type. This is frequently done using bolted joints. The 0°

direction fiber layers which are responsible for high tensile strength and compressive strength have only a very low embedding strength, however. An improved embedding strength can be obtained by an increased proportion of obliquely directed fiber layers (for example +/- 45°, +/- 30° or the like), although this reduces the tensile strength for the same cross section or the same thickness of the fiber composite.

It is thus known for the fiber composite material to be provided with a connecting region, which is formed using a reinforcement material with a high embedding strength. It is known, for example, for a monolithic or else layered titanium material to be connected to the fiber composite, with a connection whose layers are stepped being produced in order to improve the joint between the fiber composite and the reinforcement material. It is thus known for a monolithic metallic connecting region, composed of titanium for example, to be provided on a connecting edge with respectively stepped projections, which are symmetrical to the center plane with respect to the height of the connecting region, and for the fiber layers of the fiber composite to be connected in a corresponding manner. The connection to the fiber composite can be produced via the polymer matrix or via adhesive coatings.

It is furthermore known for the connecting region to be formed with metallic laminate layers whose thickness corresponds to the thickness of the fiber

layers of the fiber composite, so that stepped configuration of the connection is easy to achieve.

It is furthermore known for the composite structure formed by the fiber layers to be separated in the connecting region and for metallic layers to be inserted between the mutually separated fiber layers, in order to increase the embedding strength. Such an arrangement is known for a tube composed of a fiber composite, which has a constant internal diameter in the connecting region, but whose external diameter is enlarged by the inserted metal layers.

A disadvantage of the last-mentioned solution is the necessary asymmetry in the connecting region with respect to the fiber composite, as a result of which weak points are produced with regard to static and dynamic loads. In the other solutions, the connection between the fiber composite and the connecting region is governed exclusively by shear and adhesion forces between the fiber layers and the reinforcement material. Since such connections which are based on shear forces have only a limited tensile strength, the achievable high tensile strength of the fiber composite becomes obsolete as a result of the connecting region that is applied.

The invention is thus based on the problem of designing a composite material of the type mentioned initially such that a high tensile strength can be achieved, including the connecting region, and a high embedding strength can be achieved in the connecting

region.

Against the background of this problem, a composite material of the type mentioned initially is distinguished, according to the invention, in that the connecting region is formed from layers of the reinforcement material and by fiber layers which pass through the transitional region into the connecting region, and in that, in the transitional region between the fiber layers which pass through, fiber layers which do not pass through abut against corresponding layers composed of the reinforcement material.

In the composite material according to the invention, the connecting region is thus formed from fiber layers of the fiber composite which pass through and are combined with layers of the reinforcement material. It is thus possible to ensure a high embedding strength in the connecting region by virtue of the reinforcement material, and a high tensile strength in the transitional region, by virtue of the fiber layers which pass through. Furthermore, the connecting region can advantageously be designed to have the same thickness as the fiber composite, thus making it possible to completely avoid the creation of any asymmetries in the transition from the fiber composite to the connecting region.

It is particularly preferable for the composite material according to the invention for the abutment points between the fiber layers which do not pass through and the layers of the reinforcement material to

be arranged offset in the transitional region. The offset is in this case preferably designed such that starting from the fiber composite in the transitional region, abutment points are initially formed between the reinforcement material and fiber layers (the 90° layer for a tensile load) which contribute at least to the strength of the fiber composite to withstand a main load, for example to withstand tension, and abutment points for fiber layers of increasing importance for the strength follow offset in the direction of the connecting region. If, for example, a high tensile strength is relevant, this means that abutment points for the 90° layers are formed first of all, and that abutment points for, for example, +/- 45° layers then follow, with abutment points between 0° layers and the reinforcement material finally being formed as the last step. In this case, steps may once again be produced within the individual groups as well.

It is particularly expedient for the composite material according to the invention for the fiber layers of the fiber composite to be arranged symmetrically with respect to the center plane of the thickness of the fiber composite and for the abutment points then likewise to lie symmetrically with respect to the center plane of the thickness of the fiber composite, in each case, in the transitional region. This also makes it possible to achieve symmetry with respect to the fiber layers across the thickness of the fiber composite, into the connecting region.

The fiber layers which pass through and the layers composed of the reinforcement material are preferably formed in alternate layers in the connecting region. This maintains the desired symmetry and a high embedding strength is achieved with a high strength, which also remains in the transitional region, to withstand the main load of the fiber composite (in particular tensile strength). The fiber layers and the layers composed of the reinforcement material expediently all have the same layer thickness.

The layer thickness of the fiber layers and of the layers of the preferably metallic (titanium) reinforcement material are preferably between 0.2 and 1 mm.

From what has been said above, it is evident that, expediently, the fiber layers which pass through into the connecting region are those which are the strongest with respect to the main load of the fiber composite. The main load will in general be a tensile load, so that the layers which pass through will in general have a 0° fiber direction.

When oblique fiber directions are used, particularly with a 45° orientation, it is in each case expedient to allow a fiber layer with the +α orientation (0° < α < 90°) to in each case rest directly against a fiber layer with the -α orientation, and to design this such that the two fiber layers together have the thickness of one 0° or 90° layer. This arrangement is also used to obtain a fiber composite

whose final form with respect to its center plane is as perfect as possible.

The composite material according to the invention is particularly suitable for high-strength connecting arrangements in an aircraft, for example for optimized coupling of stringers to a wing.

The invention will be explained in more detail in the following text with reference to exemplary embodiments which are illustrated in the drawing, in which:

Figure 1 - shows, schematically, a section through a composite material having a connecting region to produce a connection to an adjacent composite material of the same type,

Figure 2 - shows an aircraft wing with stringers composed of the composite material shown in Figure 1,

Figure 3 - shows an enlarged illustration of the transitional region between the fiber composite and the connecting region,

Figure 4 - shows a detailed, further enlarged illustration of the transitional region,

Figure 5 - shows a graphical representation to illustrate the tensile strength and embedding strength values of the materials used in the composite material,

Figure 6 - shows a graphical illustration of connection tensile strength values for the transitional region according to the invention, in comparison to two transitional regions of conventional design.

Figure 1 shows a fiber composite 1 with numerous fiber layers 2 lying one on top of the other. The fiber composite 1 merges via a transitional region 3 into a connecting region 4, in which fiber layers 2 which pass through the transitional region 3 alternate with metal layers 5 to form a fiber-metal laminate 6. The connecting region 4 of the composite material is bounded on both sides by lugs 7 in order to produce a connection to a connecting region 4 of a composite material that is fitted to form an extension, and these lugs 7 are likewise in the form of a fiber-metal laminate 6. In the connecting region 4, the composite material is connected to the lugs 7 by bolted joints 8. Since the lugs 7 extend continuously into the connecting region 4 of the adjacent composite material, and are likewise connected by bolted joints 8 to the connecting region 4 of the adjacent composite material, this results in a connection between the mutually adjacent composite materials via the lugs 7.

Figure 4 shows the construction of the transitional region 3 between the fiber composite 1 and the connecting region 4.

The fiber composite 1 is composed of fiber layers 2. The fiber composite 1 is in this case a 70/20/10 fiber composite. In consequence, 70% of it is formed with a 0° fiber direction, 20% with a +/- 45° orientation, and 10% with the 90° orientation.

The fiber layers 2 with the +45° and -45° orientations lie directly against one another and are each only half the layer thickness of the other fiber layers 2, so that, together, they form a fiber layer 2 with the same layer thickness as the other fiber layers 2.

Figure 4 shows that every alternate fiber layer 2 in the fiber composite 1 is in each case a 0° layer, and is constructed such that it passes through the transitional region 3 into the connecting region 4. In the connecting region 4, the intermediate spaces located between the 0° fiber layers 2 are filled by layers 9 composed of a reinforcement material, in this case a titanium alloy, so that the regular fiber-metal laminate 6 is formed in the connecting region 4.

The layers 9 composed of the reinforcement material extend for different extents into the transitional region 3 in the direction of the fiber composite 1, where they form abutment points 10 with fiber layers 2 which do not pass through. The abutment points 10 are not all arranged at the same level in the longitudinal direction, but are stepped.

Starting from the fiber composite 1, the two 90° fiber layers 2 end first of all, and form first

abutment points 10.

This is followed by two abutment points 10 of the +45°/-45° fiber layers 2, which form two further abutment points 10 at the same height.

The two other +45/-45° fiber layers, which are further outward, form a third height of abutment points 10. This is followed, at a distance, by two abutment points 10 between two 0° fiber layers 2 and the layers 9 composed of the reinforcement material, and at a further distance by two further abutment points 10.

The fiber layers 2 are arranged such that one 0° fiber layer 2 forms a center plane 11 of the composite material. In order to allow the desired 70/20/10 composition to be achieved for a predetermined thickness of the fiber composite 1 while maintaining the symmetry, the two fiber layers 2 on the surface (at the edge) are formed by 0° layers of half the thickness.

Figure 5 shows, in comparison, values for the tensile strength and the embedding strength of pure titanium layers 9, of the fiber composite 1 composed of CFC 70/20/10, and of the construction of the connecting region 4 according to the invention with 0° fiber layers 2 (CFC UD) and titanium layers 9, in the configuration shown in Figure 4.

The embedding strength of the normally used titanium alloys is the greatest, and that for the pure fiber composite 1 would be extremely low, so that it would not sensibly be possible to form a bolted joint 8

with the pure fiber composite 1. In contrast, the fiber composite 1 has a high tensile strength, which is considerably higher than the tensile strength of the titanium alloy. The fiber-metal laminate 6 in the connecting region 4 has an embedding strength which is only slightly less than the embedding strength of the titanium alloy, while the tensile strength of the laminate 6 is of virtually the same magnitude as that of the pure fiber composite 1.

The connecting region 4 designed according to the invention thus satisfies the requirements for a high tensile strength and a high embedding strength.

With regard to this result, it is still necessary to investigate whether the high tensile strength of the fiber composite 1 and of the connecting region 4 is also maintained over the transitional region 3.

Figure 6 shows that, as expected, a somewhat reduced tensile strength is achieved in the transitional region 3 designed according to the invention. However, in terms of the order of magnitude, this is in the region of the tensile strength of the fiber composite 1 and of the connecting region 4.

However, this does not apply to conventional solutions.

Figure 6 shows a transitional region 103 in which, according to a known solution, a monolithic titanium sheet 110 is provided with a stepped end, to which fiber layers 102 are connected in a stepped

manner. The connection tensile strength of this solution is less than half as great as that of the transitional region 3 according to the invention.

Another known solution sketched in Figure 6 provides a fiber composite composed of boron fiber layers 102, which form abutment points with steel sheets 109. The steel sheets 109 are connected to one another by adhesive layers 111. The connection tensile strength of such a transitional region 113 is, as is shown in the graphical illustration, somewhat higher than in the transitional region 103, but is only about 60% of the connection strength of the transitional region 3 according to the invention.

The composite material according to the invention thus combines high tensile strength values, even in the transitional region 3, with high embedding strengths in the connecting region 4.

Claims

1. Composite material comprising a fiber composite (1), a large number of fiber layers (2) embedded in a polymer matrix, some of which preferably have fiber directions which differ from fiber directions of other fiber layers (2), and a connecting region (4) formed using a reinforcement material (9) with a high embedding strength, with a transitional region (3) being formed between the fiber composite (1) and the connecting region (4), in which fiber layers (2) abut against the reinforcement material (9) of the connecting region (4), characterized in that the connecting region (4) is formed from layers (9) of the reinforcement material and by fiber layers (2) which pass through the transitional region (3) into the connecting region (4), and in that, in the transitional region (3) between the fiber layers (2) which pass through, fiber layers (2) which do not pass through abut against corresponding layers (9) composed of the reinforcement material.

2. Composite material according to Claim 1, characterized in that the abutment points (10) between the fiber layers (2) which do not pass through and the layers (9) of the reinforcement material are arranged offset in the transitional region (3).

3. Composite material according to Claim 2, characterized in that, starting from the fiber composite (1) in the transitional region (3), abutment

points (10) are initially formed between the reinforcement material (9) and fiber layers (2) which contribute at least to the strength of the fiber composite (1) to withstand a main load, and abutment points (10) for fiber layers (2) of increasing importance for the strength follow offset in the direction of the connecting region (4).

4. Composite material according to one of Claims 1 to 3, characterized in that the fiber layers (2) of the fiber composite (1) are arranged symmetrically with respect to the center plane (11) of the thickness of the fiber composite (1).

5. Composite material according to one of Claims 1 to 4, characterized in that the abutment points (1) are in each case arranged symmetrically with respect to the center plane (11) of the thickness of the fiber composite (1).

6. Composite material according to one of Claims 1 to 5, characterized in that the fiber layers (2) which pass through and the layers (9) composed of the reinforcement material are formed in alternate layers in the connecting region (4).

7. Composite material according to Claim 6, characterized in that the fiber layers (2) and the layers (9) composed of the reinforcement material all have the same layer thickness.

8. Composite material according to one of Claims 1 to 7, characterized in that the fiber layers (2) which pass through are formed by fiber layers which are

strong with respect to a tensile load.

9. Composite material according to Claim 8, characterized in that the fiber layers (2) which pass through are formed with a fiber direction which has a 0° direction with respect to the tensile load.

10. Composite material according to one of Claims 1 to 9, characterized in that a proportion of layers (2) in the fiber composite (1) is provided with a 90° fiber direction.

11. Composite material according to one of Claims 1 to 10, characterized in that a proportion of layers (2) in the fiber composite (1) is provided with a fiber direction of +/- 45°.

12. Composite material according to one of Claims 1 to 11, characterized in that fiber layers (2) having an oblique fiber orientation (α) each rest directly against a fiber layer (2) with the mirror-image symmetrical orientation ($-\alpha$) with respect to the longitudinal direction, and in that both fiber layers (2) together have the thickness of one 0° or 90° layer.

13. Composite material according to one of Claims 1 to 12, characterized in that the reinforcement material is formed by metal layers.

14. Composite material according to one of Claims 1 to 13, characterized by the fiber layers (2) and layers (9) composed of the reinforcement material having a layer thickness of between 0.2 and 1 mm.

Abstract

A composite material comprising a fiber composite (1), a large number of fiber layers (2) embedded in a polymer matrix, some of which preferably have fiber directions which differ from fiber directions of other fiber layers (2), and a connecting region (4) formed using a reinforcement material (9) with a high embedding strength, with a transitional region (3) being formed between the fiber composite (1) and the connecting region (4), in which fiber layers (2) abut against the reinforcement material (9) of the connecting region (4), can be formed with a high overall tensile strength and a high embedding strength in the connecting region (4) in that the connecting region (4) is formed from layers (9) of the reinforcement material and by fiber layers (2) which pass through the transitional region (3) into the connecting region (4), and in that, in the transitional region (3) between the fiber layers (2) which pass through, fiber layers (2) which do not pass through abut against corresponding layers (9) composed of the reinforcement material.

(Figures 1 to 3)

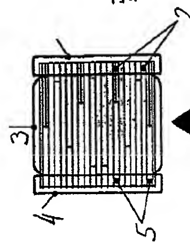

Fig. 3

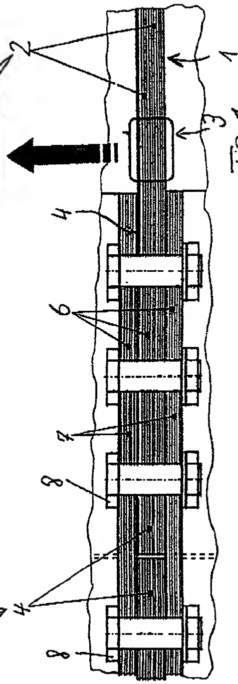

Fig. 1

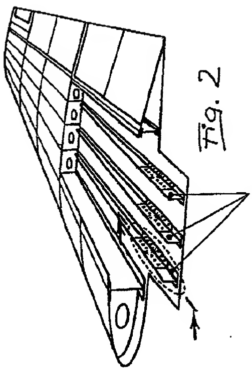

Fig. 2

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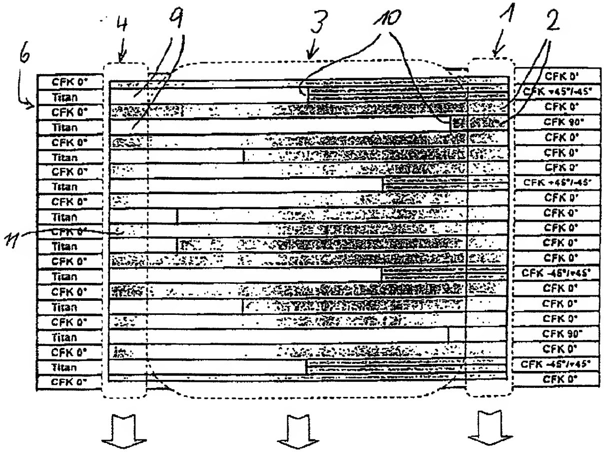

Fig. 4

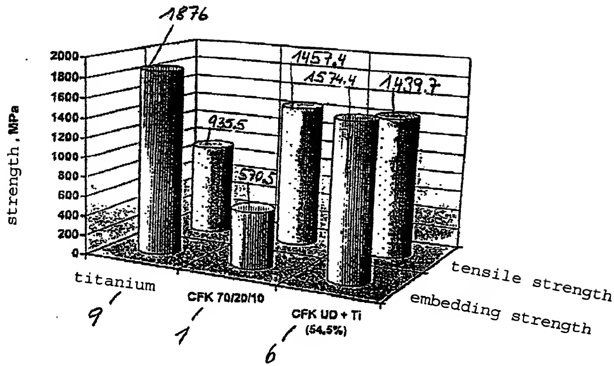
1876
2000
1800
1600
1400
1200
1000
800
600
400
200
0
strength, MPa
935.5
570.5
1457.4
1574.4
1439.7
titanium
CFK 70/20/10
CFK UD + Ti
(54.5%)
9
1
6
tensile strength
embedding strength

Fig. 5

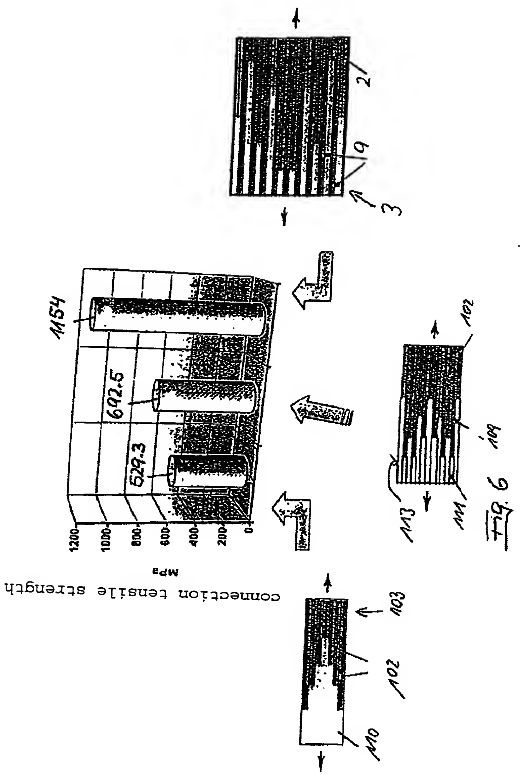
2
9
3
1154
692.5
529.3
1200
1000
800
600
400
200
0
MPa
connection tensile strength
102
109
113
111
103
102
110

Fig. 6

Atty. Dkt. No. 016794/0415

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I HEREBY DECLARE:

THAT my residence, post office address, and citizenship are as stated below next to my name;

THAT I believe I am the original, first, and sole Inventor (if only one inventor is named below) or an original, first, and joint inventor (if plural inventors are named below or in an attached Declaration) of the subject matter which is claimed and for which a patent is sought on the invention entitled

COMPOSITE MATERIAL HAVING A REINFORCED CONNECTING REGION

(Attorney Docket No. 016794/0415)

the specification of which (check one)

____ is attached hereto.

_X_ was filed on March 20, 1999 as United States Application Number or PCT International Application Number PCT/DE99/00790 and was amended on ________________ (if applicable)

THAT I do not know and do not believe that the same invention was ever known or used by others in the United States of America, or was patented or described in any printed publication in any country, before I (we) invented it;

THAT I do not know and do not believe that the same invention was patented or described in any printed publication in any country, or in public use or on sale in the United States of America, for more than one year prior to the filing date of this United States application;

THAT I do not know and do not believe that the same invention was first patented or made the subject of an inventor's certificate that issued in any country foreign to the United States of America before the filing date of this United States application if the foreign application was filed by me (us), or by my (our) legal representatives or assigns, more than twelve months (six months for design patents) prior to the filing date of this United States application;

THAT I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above;

THAT I believe that the above-identified specification contains a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

THAT I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

Atty. Dkt. No. 016794/0415

I HEREBY CLAIM foreign priority benefits under Title 35, United States Code §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number	Country	Foreign Filing Date	Priority Claimed?	Certified Copy Attached?

I HEREBY CLAIM the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

U.S. Provisional Application Number	Filing Date

I HEREBY CLAIM the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number

I HEREBY APPOINT the following registered attorneys and agents of the law firm of FOLEY & LARDNER:

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to have full power to prosecute this application and any continuations, divisions, reissues, and reexaminations thereof, to receive the patent, and to transact all business in the United States Patent and Trademark Office connected therewith.

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I UNDERSTAND AND AGREE THAT the foregoing attorneys and agents appointed by me to prosecute this application do not personally represent me or my legal interests, but instead represent the interests of the legal owner(s) of the invention described in this application.

I FURTHER DECLARE THAT all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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